

REMARKS

This is a response to the non-final Office Action dated July 28, 2004.

Regarding paragraph 1 of the Office Action and the use of underlining and bolding in some section headings in the application, Applicant appreciates the Examiner pointing out the suggested format provided by 37 C.F.R. §1.77(b), but notes that the use of the term "should" in this rule indicates that the format in which underlining and bolding is not used for section headings is suggested but not required. The Examiner is respectfully requested to reconsider this tangential issue.

Regarding paragraph 3 of the Office Action, a new Abstract is being submitted.

The specification is amended to conform the Summary section with the amended claims. Additionally, typographical errors are corrected in that the reference numeral for the DASD controllers should be 502, not 501, and the reference numeral for the host adapter should be 520, not 510 (see Fig. 5).

Claims 1-11, 13-28, 30-34, 36-36 and 48-52 are amended, claims 12, 29, 35 and 47 are cancelled, and claim 53-56 are new. Claims 11, 28 and 46 are amended to incorporate the subject matter of claims 12, 29 and 47, respectively. The claims are generally amended to improve clarity. Regarding claims 1, 18, and 36, see, e.g., Fig. 1, where Vol. A is a first volume, Vol. B is a second volume, Vol. C is a third volume, and Vol. 4 is a fourth volume. Regarding point in time virtual copying, an example of which is flash copying, see, e.g., the specification, page 11, lines 17-21 and page 13, lines 13-19. Regarding claims 2, 19, and 37, see page 3, lines 25-27. Regarding claims 3, 20 and 38, see page 11, lines 17-19. Regarding claims 5, 22 and 40, see page 13, lines 13-16. The remaining claims are amended for consistency and to improve readability. New claims 53-55 are based on the specification, e.g., page 2, lines 26-29, and page 10, lines 15-18. New claim 56 is based on claim 1 and the specification, e.g., page 2, lines 26-29, and page 10, lines 15-18.

The independent claims now clarify that database updates are transmitted from a primary site to a remote site using first and second volumes at the primary site, and third and fourth volumes at the remote site. A point in time virtual copy is performed to copy modified data from the first volume to the second volume by use of bitmaps. The second volume is synchronized with the third volume by transmitted modified data of the second volume to the third volume. At

the remote site, a second point in time virtual copy is performed to copy the modified data of the third volume to the fourth volume. Advantageously, during the synchronizing, the first volume remains accessible to a host at the primary site, and the fourth volume remains accessible to a host at the remote site.

Claims 1-52 have been rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. patent 6,446,176 to West et al. in view of U.S. patent 6,643,671 to Milillo et al. Applicant respectfully traverses the rejection.

Regarding the Examiner's statement on page 4 of the Office Action. "As to claim 1, West et al. teaches a method for synchronously transmitting one or more incremental database updates...", note that Applicant's invention refers to asynchronously transmitting database updates from a primary site to a remote site. Regarding the cite to col. 6, lines 1-14 of West et al., this passage is not relevant to Applicant's invention since the passage only describes how data sent on a bridge volume presents a status. The present invention does not refer to bridge volumes. Generally, West et al. is concerned with sending data from a primary bridge volume to a secondary bridge volume, and a normal ending status presentation is sent from the secondary controller to the primary controller. Then, the secondary bridge volume is offloaded independent of primary activity to the real target volumes corresponding to the real primary volumes. If the offload fails for any reason in the secondary controller, another bridge volume is used to send the status of the failure to the primary controller. However, this teaching does not relate to the present invention as claimed

Regarding the assertion in page 5 of the Office Action that Milillo et al. teach destaging modified data to a primary volume, Applicant's claims clarify that data is destaged to a first volume, from which a point in time virtual copy is made to a second volume. Thus, in this copy relationship, the first volume is a source volume and the second volume is a target volume. Accordingly, data is destaged to a source volume, not a primary volume, as with Milillo et al.

Furthermore, Milillo et al. uses a "trio" of a source volume, primary target volume and a secondary volume (Figs. 2 and 4). There is no disclosure or suggestion of the use of four volumes as set forth in Applicant's claims. The present invention uses four volumes in order to maintain disaster recovery at all times with the best possible performance. Moreover, since Milillo et al. are transferring data asynchronously from a bit map, the data at the remote location is not usable or consistent during the actual write cycle. If a disaster happens at the primary site

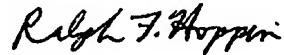
or the communication lines break between the volumes, the data at the remote site is not usable. To prevent this, the present invention uses a fourth volume at the remote site, which always contains the last known good consistency group of data.

In another approach of Milillo et al., data is sent in the order that it was received. This reduces the chance of inconsistent data at the remote location at the expense of performance. This performance loss may make the system unusable for a particular customer that is worried about the currency of its data and how much data loss can be expected in the case of a disaster or power outage. Applicant's design overcomes this problem by destaging modified data, e.g., that is stored in cache, to a first (source) volume prior to performing a point in time virtual copy, or FlashCopy, to a second (target) volume to prevent any data loss due to cache corruption or power outage at the application site. In contrast, the so-called destage of Milillo et al. is done from the source volume to the primary volume prior to transmitting the data. In the present invention, the point in time virtual copy does not cause a data movement or a physical copy of the data from the source volume to the target volume. Instead, when data is accessed to be transferred to the remote secondary site, the data is actually staged from the first (source) volume, and is then sent by the second (target/primary) volume as if it really existed on the second volume.

In view of the above, it can be seen that Applicant's invention is not obvious in view of the cited references. Withdrawal of the rejection is therefore respectfully requested.

In view of the foregoing remarks, it is respectfully submitted that this application is in condition for allowance. Accordingly, it is respectfully requested that this application be allowed and a Notice of Allowance be issued. If the Examiner believes that a telephone conference with the Applicant's attorneys would be advantageous to the disposition of this case, the Examiner is requested to telephone the undersigned.

Respectfully submitted,



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